

UNITED STATES PATENT APPLICATION

OF

Kyung Chul WOO, Jin Woong KIM, Soo Young OH, Hyun Seok SEO,

Tae Hee LEE, and Joon Woo KIM,

FOR

DRUM-TYPE WASHING MACHINE

[0001] This application claims the benefit of Korean Application No. 10-2002-0075909 filed on December 2, 2002, which is hereby incorporated by reference.

BACKGROUND OF THE INVENTION

5 Field of the Invention

[0002] The present invention relates to drum type washing machines, and more particularly, to a drum-type washing machine having a water adsorption acceleration means provided at the exiting end of a water circulating pipe.

Discussion of the Related Art

10 [0003] Generally speaking, laundering using a drum-type washing machine is carried out using a frictional force between the laundry and a rotating drum that receives the driving force of a motor to perform washing, rinsing, and dewatering steps. - Such a method causes little damage to the laundry, prevents the laundry from getting tangled, and achieves such washing effects as beating and rubbing.

15 [0004] Referring to FIG. 1, a drum-type washing machine according to a related art is comprised of an outer tub 2 for containing washing water, suspended in a cabinet 1 and having an open front side; an inner tub 3 for holding laundry, rotatably mounted in the outer tub; a water discharge pump 5, in communication with the outer tub through a first water discharge pipe 4a, for pumping water to be discharged from the outer tub; a circulating pipe
20 4b, in communication with the outer tub through a gasket 7 forming a seal between a door 2a and the open front side of the outer tub, for re-circulating the washing water pumped by the water discharge pump; a second water discharge pipe 4c for discharging water pumped by the water discharge pump; and a changeover valve 6, disposed at a branching point of the circulating pipe and second water discharge pipe, for controlling a flow direction of the

washing water.

[0005] In the operation of the above drum-type washing machine, with laundry loaded in the inner tub 3, a washing mode is selected so that an appropriate amount of washing water is supplied to the inner tub, which is then rotated at a low speed to perform washing. As washing thus proceeds, the washing water is continuously pumped by the water discharge pump 5, to be re-supplied to the outer tub 2 through the controlled changeover valve 6 and the circulating pipe 4b. Upon completion of the washing, the washing water is pumped by the water discharge pump 5 and is discharged through the controlled changeover valve 6 and the second water discharge pipe 4c.

[0006] The washing step as described above is followed by at least one rinsing step in which the same basic procedure is repeated. That is, in washing and rinsing, re-circulated water rains down upon the laundry in the inner tub 3 from an upper point of the gasket 7.

[0007] In the drum-type washing machine according to the related art as described above, however, the raining water fails to be thoroughly adsorbed in the laundry during a given step of washing or rinsing, and detergent is incompletely dissolved in the water in the washing step. As a result, wash performance is poor.

SUMMARY OF THE INVENTION

[0008] Accordingly, the present invention is directed to a drum-type washing machine that substantially obviates one or more of the problems due to limitations and disadvantages of the related art.

[0009] An object of the present invention, which has been devised to solve the foregoing problem, lies in providing a drum-type washing machine, in which water adsorption is accelerated during washing and rinsing steps.

[0010] It is another object of the present invention to provide a drum-type washing machine, in which detergent is more uniformly dissolved into washing water.

[0011] It is another object of the present invention to provide a drum-type washing machine, in which washing performance is improved.

5 [0012] It is another object of the present invention to provide a drum-type washing machine, in which wash time is shortened.

[0013] Additional features and advantages of the invention will be set forth in the description which follows, and in part will be apparent to those having ordinary skill in the art upon examination of the following or may be learned from a practice of the invention. The
10 objectives and other advantages of the invention will be realized and attained by the subject matter particularly pointed out in the specification and claims hereof as well as in the appended drawings.

[0014] To achieve these objects and other advantages in accordance with the present invention, as embodied and broadly described herein, there is provided a drum-type washing
15 machine comprising a water discharge pump for circulating water; a tub for containing laundry, the circulating water of the water discharge pump being adsorbed in the laundry; a water circulating pipe, in communication with the tub, for re-circulating the water circulated by the water discharge pump; and water adsorption acceleration means, disposed at one end of the water circulation pipe, for facilitating the adsorption of water in the laundry by processing
20 the re-circulated water before reintroduction to the tub via the water circulation pipe. The water adsorption acceleration means of the present invention may be realized by an electrical charging means, an ultrasonic wave generating means, or both.

[0015] It is to be understood that both the foregoing explanation and the following detailed description of the present invention are exemplary and illustrative and are intended to

provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] The accompanying drawings, which are included to provide a further
5 understanding of the invention and are incorporated in and constitute a part of this application,
illustrate embodiment(s) of the invention and together with the description serve to explain
the principle of the invention. In the drawings:

[0017] FIG. 1 is a side sectional view of a drum-type washing machine according to a
related art;

10 [0018] FIG. 2 is a side sectional view of a drum-type washing machine in accordance
with a first preferred embodiment of the present invention;

[0019] FIG. 3 is a side sectional view of a drum-type washing machine in accordance
with a second preferred embodiment of the present invention; and

[0020] FIG. 4 is a side sectional view of a drum-type washing machine in accordance
15 with a third preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0021] Reference will now be made in detail to the preferred embodiments of the
present invention, examples of which are illustrated in the accompanying drawings.
20 Throughout the drawings, like elements are indicated using the same or similar reference
designations where possible.

[0022] The drum-type washing machine according to the present invention is
provided with water adsorption acceleration means at the exiting end of a water circulation
pipe. The water adsorption acceleration means facilitates the adsorption of water in laundry

by processing the re-circulated water before its reintroduction to an outer tub via the water circulation pipe. The water adsorption acceleration means of the present invention may be realized by an electrical charging means, an ultrasonic wave generating means, or both.

[0023] Referring to FIG. 2, a drum-type washing machine in accordance with a first preferred embodiment of the present invention comprises an outer tub 20 for containing washing water, suspended in a cabinet 10 and having an open front side; an inner tub 30 for holding laundry, rotatably mounted in the outer tub; a water discharge pump 50, in communication with the outer tub through a first water discharge pipe 40a, for pumping water to be discharged from the outer tub; a circulating pipe 40b, in communication with the outer tub through a gasket 70 forming a seal between a door 20a and the open front side of the outer tub, for re-circulating the washing water pumped by the water discharge pump; a second water discharge pipe 40c for discharging water pumped by the water discharge pump; and a changeover valve 60, disposed at a branching point of the circulating pipe and second water discharge pipe, for controlling a flow direction of the washing water.

[0024] According to the first embodiment of the present invention, a drum-type washing machine further comprises means for electrically charging the circulating water in the water circulating pipe 40b just before entry into the outer tub 20. The electrical charging means is installed in the exiting end of the water circulating pipe 40b and comprises a pair of electrodes 80a and a DC power source 80b for applying a voltage to the electrodes via lead lines 80c. The electrodes 80a are fitted onto opposing inner surfaces of the water circulating pipe 40b above the gasket 70, and the DC power source 80b is disposed at the ends of the lead lines. The DC power source 80b may be obtained by rectifying the output of a step-down transformer (not shown) supplied with commercial AC voltage.

[0025] In washing and rinsing steps using the drum-type washing machine as shown

in FIG. 2, water is continuously re-circulated through the water circulating pipe 40b, to rain down onto the wet laundry in the inner tub 30. As the circulating water passes the electrodes 80a, the water molecules are positively (or negatively) charged by the voltage of the DC power source 80b. The electrically charged water rains down onto the wet laundry, and in particular, the water of the wet laundry, which is electrically neutral and therefore possesses an attractive force with respect to the charged water molecules being supplied from the water circulating pipe 40b. As a result, the water having the charged molecules is adsorbed in the laundry more quickly so that a more thorough adsorption is achieved during a washing or rinsing step. Moreover, by the repeated charging of the continuously re-circulated water via the water circulating pipe 40b during washing and rinsing, adequate washing and rinsing can be achieved with less water, thus conserving water.

[0026] Referring to FIG. 3, a drum-type washing machine in accordance with a second preferred embodiment of the present invention comprises, in lieu of the electrical charging means of the first embodiment, means for generating an ultrasonic wave in the circulating water in the water circulating pipe 40b just before entry into the outer tub 20. The ultrasonic wave generating means is installed at the exiting end of the water circulating pipe 40b and comprises a pair of ultrasonic vibration plates 90b and an ultrasonic oscillator 90a for generating an ultrasonic wave of a predetermined frequency to be applied via the plates as a mechanical vibratory energy to the circulating water. An ultrasonic transducer 90c is attached to the ultrasonic vibration plates 90b for transducing the power of the ultrasonic wave into the mechanical vibratory energy. The ultrasonic vibration plates 90b are fixed to opposing outer surfaces of the water circulating pipe 40b above the gasket 70, to apply the mechanical vibratory energy to the circulating water.

[0027] In washing and rinsing steps using the drum-type washing machine as shown

in FIG. 3, water is continuously re-circulated through the water circulating pipe 40b, to rain down onto the wet laundry in the inner tub 30. As the circulating water passes the ultrasonic vibration plates 90b, the ultrasonic oscillator 90a generates an ultrasonic wave, the ultrasonic wave transducer 90c transduces the power of the wave into a mechanical vibratory energy of a corresponding frequency, and the vibratory energy is transmitted through the ultrasonic vibration plates to the water flowing through the water circulating pipe 40b, thus producing cavitations in the flowing water. As a result, the water having the cavitations is adsorbed in the laundry more quickly, so that a more thorough adsorption is achieved during a washing or rinsing step, since smaller water particles are produced by a breaking up of the water by the cavitations.

[0028] In the washing step in particular, the thus-produced cavitations in the water activate the molecular motion of the water with respect to detergent and apply an impact to the detergent to accelerate its uniform dissolution into the water.

[0029] Moreover, the impact of the cavitations facilitates the breaking up, softening, and separation of solids and oily components adhered to surfaces of the laundry being washed or rinsed.

[0030] Referring to FIG. 4, a drum-type washing machine in accordance with a third preferred embodiment of the present invention comprises the electrical charging means of the first embodiment as well as the ultrasonic wave generating means of the second embodiment. The charging means and ultrasonic wave generating means are each installed, in close succession, at the exiting end of the water circulating pipe 40b. Preferably, the installation location of the electrical charging means precedes that of the ultrasonic wave generating means, with respect to the flowing direction of the re-circulating water.

[0031] In the operation of the drum-type washing machine of the third embodiment,

the effect of the electrical charging means is achieved in tandem with the effect of the ultrasonic wave generating means. Thus, the effect of accelerating the adsorption of water in the laundry is further enhanced, to improve washing performance of the drum-type washing machine adopting the present invention accordingly.

5 **[0032]** It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover such modifications and variations, provided they come within the scope of the appended claims and their equivalents.